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Nano scaled electro catalysts, a versatile concept for novel solid state fuel cells and electro-catalytic reactors.

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Solid state electrochemical cells based on oxygen ion conducting electrolytes are mostly known for their application as lambda sensors and currently under development as solid oxide fuel and electrolysis cells. The transport of oxygen through the electrolyte to and from the fuel electrode can be used to convert a large variety of high energy density fuels such as hydro carbons with superior efficiency than in conventional combustion processes. The cells can also be used to reduce other oxygen containing species such as NO_x. During the recent years, a novel electrode concept has been developed, that is based on decoupling the electro chemical activity and current collection in the electrode. By using a ceramic porous scaffold, and incorporating additional electro catalysts, the electrochemical activity can be tailored to the desired application of the cell. The concept will be explained and examples provided for novel electrodes and their application.

For solid oxide fuel cells, strontium titanates have been developed as the support material and various metals (Fe, Pd, Pt, Ru) have been incorporated and investigated towards their performance in natural gas based fuels for micro CHP. Stable structures can be achieved even at operating temperatures as high as 850 C (1). Cell performance was shown compatible with state-of the art Ni based cells reaching 0.5 W cm⁻².

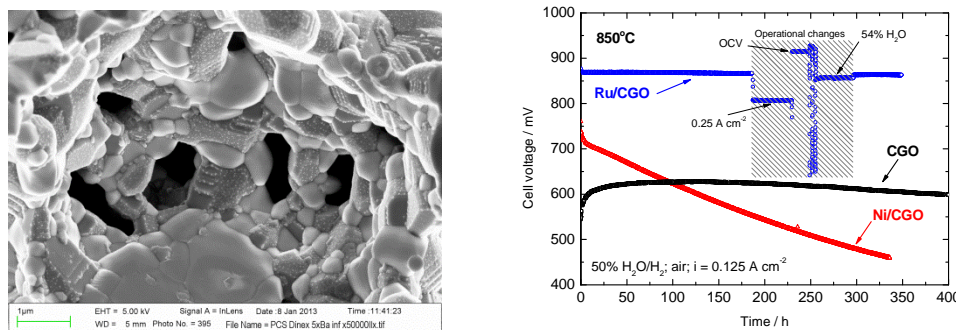


Figure (left): Porous ceramic electrode with impregnated Ba-oxide, (right): durability test of a full ceramic SOFC anode.

Another application is the development of NO_x selective electrodes for cleaning of engine exhaust gases. Here the oxygen electrode, typically La-Mn perovskites, which are stable and electrically conductive in oxidizing atmospheres are used as the catalyst support (2,3). Addition of BaO onto the perovskite surface has increased the reduction of NO_x to N₂. The mechanism is still under investigation, but a strong interaction between the electro catalyst and the support is indicated by advanced in-operando spectroscopic studies.

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